Results: The fluorescence response increased linearly with the absorbed dose from 0 to 200 Gy. The absorbance also increased linearly, indicating that the fluorescent dye is the only chemical in the material with a significant absorption in the relevant wavelength range. The dye absorbs from 500 nm to 575 nm and the fluorescence response is in the range from 565 nm to 650 nm.

Conclusion: We have established that the material exhibits a linear relationship between fluorescence response and radiation dose. The fluorescence response is strong enough to be used at low doses. Measurements on individual samples are highly reproducible, but the variance between different samples is still too high to be used at clinically relevant doses. We expect that this variance can be reduced through improvements to the sample preparation. The fluorescence response of the radiochromic dye is highly dependent on the composition of the polymer matrix, since a different study[3] using the same dye observed a decrease in fluorescence with increasing dose. The factors affecting the fluorescence of the dye and hence its dosimetric properties are still being investigated, but in this work we have shown that dosimetry measurements are possible with this novel material. With improvements this could become a precise quantitative 3D dosimeter that is inexpensive, quick, and easy to use.

[3] A.A.Abdel-Fattah, W.B.Beshir, El-Sayed A.Hegazy, H.Ezz El-Din. Photo-luminescence of Risø B3 and PVB films for application in radiation dosimetry. Radiat. Phys. Chem. 62 (2001) 423-428.

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Effects on dosimetric measurements due to difference in calibration and dosimetry protocols followed

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Purpose or Objective: Radiation dosimetry plays a vital role in external beam radiotherapy. For precise and accurate dose delivery, the dosimetry system should be calibrated properly, following the recommendations of standard dosimetry protocols e.g. TG-51 or TRS-398. Nonetheless, the dosimetry protocol followed by calibration laboratory is often different from the protocols in practice at various clinics. The study is designed to investigate the effects added in dosimetry measurements due to such situations.

Material and Methods: In this study, the dosimetry were performed for a Co-60 teletherapy unit and a high-energy Varian linear accelerator (CLINAC) with 6 and 15 MV-photon and 6, 9, 12 and 15 MeV-electron beams, following the recommendations and reference conditions of AAPM TG- 51 and IAEA TRS-398 dosimetry protocols. A PTW water phantom (T41014) with a cylindrical chamber (PTW-30001) connected to an electrometer (PTW UNIDOS E) was used for the absolute dosimetry of Co-60 unit. Similarly, dosimetry systems consisting of a farmer type ionization chamber (IBA-FC65-G) and a plane-parallel chamber (IBA PPC-05), connected to an electrometer (PTW UNIDOS E) in a Wellhofer water phantom was used for absolute dosimetry of two photon beams and four electron beams dosimetry respectively. Each chamber type combined with PTW UNIDOS E was calibrated in a Co-60 radiation beam at Secondary Standard Dosimetry Laboratory (SSDL) PINSTECH, Pakistan, following the IAEA TRS-398 protocol.

Results: The measured ratios of absorbed doses to water Dw (TG-51/TRS-398) were 0.999 and 0.997 for 6 and 15 MV photon beam respectively whereas the ratios were 1.013, 1.009, 1.003 and 1.000 for 6, 9, 12 and 15 MeV electron beams, respectively as shown in Figure 1 (a & b). The difference arises between the two protocols mainly due to beam quality (KQ) and ion recombination correction factor (Table 1).

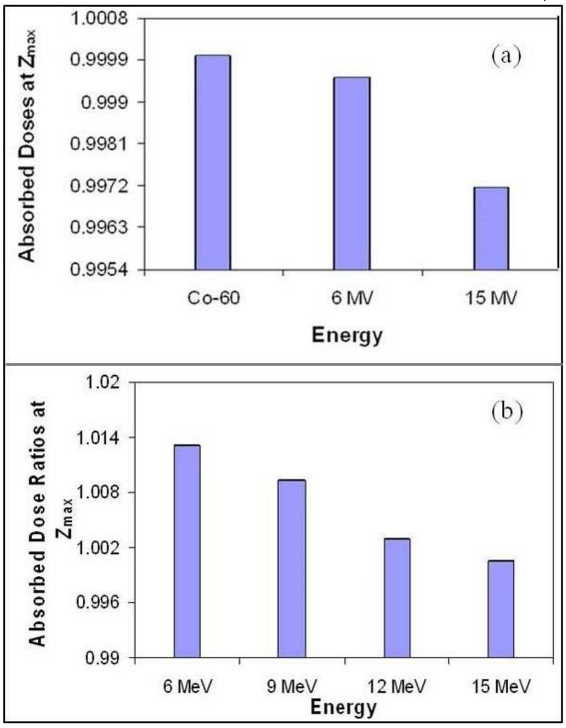

Figure 1: (a) Ratio of the absorbed doses at Zmax of Co-60, 6 MV and 15 MV photons by using two protocols (TG-51 / TRS-398). **(b)** Ratio of the absorbed doses at Zmax of 6, 9, 12, 15 MeV Electron beam by using two Protocols (TG-51 / TRS-398).

Table 1: Comparison of the Absorbed Doses at Z_{max}, bean quality factor (K_q) and ion recombination correction factor, (P_{ion}) values of AAPM TG-51 and IAEA TRS-398 Protocols.

Type of Beam	Energy	AAPM TG-51					IAEA TRS-398				
		%dd(10)x		P_{ion}	K_q	$D_w(Z_{max})$	$TPR_{20,10}$		P_{ion}	K_q	$D_w(Z_{max})$
Photon	6 MV	66.7		1.00734	0.991	0.9970	0.668		1.00714	0.992	0.99748
	15 MV	77.63		1.01135	0.970	0.9967142	0.762		1.01109	0.973	0.999535
	Co-60	NA		1.0	1.0	1.6489	NA		1.0	1.0	1.6489
Electron		R_{50} (cm)	Z_{ref} (cm)				Z_{max} (cm)	$R_{50,ion}$ (cm)			
	6 MeV	2.15	1.19	1.023	0.937	1.026418	1.08	2.15	1.023	0.923	1.013106
	9 MeV	3.459	1.975	1.00503	0.921	1.0056445	1.99	3.42	1.00455	0.913	0.99643
	12 MeV	4.910	2.846	1.013377	0.908	1.005852	2.44	4.83	1.013099	0.905	1.002825
	15 MeV	6.237	3.642	1.013551	0.8983	0.998504	2.8	6.12	1.013277	0.898	0.997916

Conclusion: In conclusion TRS-398 gives relatively high doses than TG-51 and the percentage difference increases as the energy increases for photon beams. While in case of electron beams TG-51 calculates relatively high doses than TRS-398 and percentage difference decreases as the energy increases. Since the chambers are calibrated according to the recommendations of IAEA TRS-398 Dosimetry protocol, all the medical centres are requested to follow the IAEA TRS-398 Dosimetry protocols.

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Small field output correction factors for 6-X and 6-X FFF beams: GAMOS Monte-Carlo study

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Purpose or Objective: Our purpose was to calculate detector specific small field output correction factors with GAMOS Monte Carlo (MC) for 6-X and 6-X flattening filter free (FFF). In this study MC simulations and water phantom measurements were used to obtain correction factors.

Material and Methods: A formalism of Alfonso et al for correction of output factor measurements was used in the current study. Absorbed dose to water was calculated with MC using 2x2x2 mm^2 voxel at 5 cm depth of water phantom. “Range cut” and “Kill particles at BIG X/Y” options were used to optimize simulation in GAMOS MC. Results were obtained below 2% statistical noise. Fields sizes varied from 4x4 to 1x1